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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: *Ex Parte* Filing of Sirius Satellite Radio Inc. in ET Docket No. 98-42

Dear Ms. Salas:

On behalf of Sirius Satellite Radio Inc. (formerly CD Radio Inc., hereinafter "Sirius"), and pursuant to Part 1.1206 of the Commission's Rules, we hereby submit the attached study of harmful interference from RF lighting devices to Sirius' terrestrial receivers. At the time Sirius filed comments in the above-referenced docket, the company was in the process of developing a thorough study of the harmful interference to spectrum-based communications, such as the satellite digital audio radio service ("satellite DARS"), that RF lighting devices might generate. Because the attached study goes to the core technical issue in this proceeding, Sirius believes that the Commission's record would be incomplete without it.

Sincerely,

John F Papandrea

Carl R. Frank
John F. Papandrea
Counsel to Sirius Satellite Radio

Enclosure: Analysis of Interference from RF Lighting Devices into Sirius Satellite Terrestrial Receivers

cc: Julius Knapp, Office of Engineering and Technology
John Reed, Office of Engineering and Technology
Attached Service List

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List A B C D E

Analysis of Interference from RF Lighting Devices into Sirius Satellite Terrestrial Receivers
May 24, 2000

Sirius Satellite Radio Inc.
1221 Avenue of the Americas
New York, NY 10020

Analysis of Interference from RF Lighting Devices into Sirius Satellite Terrestrial Receivers
24 May 2000

1. Introduction

In 1985, the FCC classified RF lighting devices to be Part 18 Industrial, Scientific, and Medical (ISM) equipment and adopted rules to control harmful interference to spectrum-based communications services that might be generated by such devices. Recent developments and advances in RF lighting technology have caused the FCC to put out a Notice of Proposed Rulemaking (NPRM) (adopted April 1, 1998) in order to review and update, if necessary, their rules to accommodate these new technological advancements in RF lighting to the extent possible while continuing to protect communications services from harmful interference. This report will analyze the potential interference from RF lighting devices operating in the 2400 - 2500 MHz band into Sirius Satellite Radio terrestrial receivers operating in the 2320 - 2332.5 MHz band. The report will analyze the current FCC rules on emissions from RF lighting devices, as well as the proposed limits given in the NPRM. The report will also develop appropriate limits on the emissions of RF lighting devices in order to ensure protection of the Sirius Satellite receivers.

2. Parameters for Sirius Satellite Radio Receivers

The Sirius Satellite receivers will either be mobile or fixed receivers and will receive the transmitted signal from either a satellite or a terrestrial repeater. The satellite to mobile receiver link is more sensitive than the terrestrial repeater to mobile receiver link and will be used in this analysis. The parameters for the satellite to mobile receiver link are taken from the Application of Satellite CD Radio, Inc. to Modify Authorization (December 11, 1998). Table 2-1 gives the relevant parameters for these links.

Table 2-1. Parameters of Sirius Satellite to Receiver Links

Type of Receiver	Mobile/Fixed
Satellite Edge of Coverage EIRP (dBW)	61.1
Single Channel EIRP (dBW)	-18.4
Elevation Angle from Receiver to Satellite (°)	35
Frequency (MHz)	2326
Distance to Receiver (assume satellite at apogee - altitude of 47102 km) (km)	49565.9
Path Loss (dB)	193.7
Receiver Antenna Gain (dBi)	3.5
Received Power (dBW)	-147.5
Noise Bandwidth (kHz)	64
System Noise Temperature (K)	158
Receiver Noise Power Density (dBW/kHz)	-158.5

3. Parameters of RF Lighting Devices

RF Lighting devices produce light by using RF energy to stimulate gases contained inside a glass tube (or lamp). The current FCC rules do not include radiated emission limits above 1 GHz for RF lighting devices. However, in Section 18.305(b) of the FCC's rules, there are field strength limits on levels of emissions which lie outside of the specified ISM frequency bands (out-of-band emission limits) for miscellaneous ISM devices. The limit for equipment operating on any ISM frequency is 25 microvolts per meter at 300 meters. This limit assumes that the RF power generated by the ISM equipment is less than 500 watts. In one submission to the FCC, an RF Lighting proponent stated that a transmitted power of 50 milliwatts would be used.

In the NPRM, the FCC proposes to modify Section 18.305(c) of the FCC's rules to include radiated emission limits above 1 GHz for RF lighting products. They propose a limit of 100 microvolts per meter at 30 meters for non-consumer equipment and 50 microvolts per meter at 30 meters for consumer equipment. The NPRM also asked for comments on the alternative of applying the radiated emission limits for microwave ovens in Section 18.305(b) of the FCC's rules to radiated emissions from RF lighting products above 1000 MHz. These proposed limits are average limits over a resolution bandwidth of 1 MHz. It should be noted that, in the case of microwave ovens, the transmitted signal is pulsed and in the case of RF lighting, the transmitted signal is continuous. Table 3-1 summarizes the current and proposed limits. It should be noted that in discussions with the FCC, it has been made clear that if the proposed limits in the NPRM are adopted, the more stringent of the limits would apply to RF lighting devices that are operated outdoors.

Table 3-1 Current and Proposed RF Lighting Out-of-Band Emission Limits

Source	Operating Frequency Band (MHz) of ISM Device	Field strength limit (microvolts per meter)	Distance (meters)
Code of Federal Regulations 18.305 (b) - miscellaneous equipment	Any ISM Frequency (2400 - 2500 MHz is included)	25	300
Code of Federal Regulations induction cooking ranges 18.305(b)	Above 90 kHz	300	30
NPRM non-consumer equipment	2400 - 2500 MHz	100	30
NPRM consumer equipment	2400 - 2500 MHz	50	30

3.1 Conversion of Field Strength Limits to Equivalent Transmitted EIRP Levels

As the RF lighting limits are given as an electric field strength in microvolts per meter, it is useful to convert these values into an equivalent EIRP from the transmitting device (in dBW) to use in the determination of the interference to a Sirius Satellite terrestrial receiver. Equation (1) contains an approximation to convert field strength to effective EIRP from the transmitting device.

$$\frac{EIRP}{4 \bullet \pi \bullet D^2} = \frac{E^2}{120 \bullet \pi} \qquad (1)$$

where:

EIRP is the EIRP of the transmitting device in Watts;
D is the distance of the measuring point from the electrical center of the transmitting device antenna in meters;
E is the field strength in volts/meter.

Simplifying equation (1) leads to the following equation to determine the transmitted EIRP from an RF lighting device.

$$EIRP = \frac{(D \bullet E)^2}{30} \qquad (2)$$

Table 3.1-1 gives the EIRP levels corresponding to the current and proposed RF lighting emission limits given in Table 3-1.

Table 3.1-1 Equivalent Transmitted EIRP Levels for Current and Proposed RF Lighting Emission Limits

Source	Frequency Band (MHz)	Equivalent Transmitted EIRP (dBW)
Code of Federal Regulations 18.305 (b) - miscellaneous equipment	Any ISM Frequency (2400 - 2500 MHz is included)	-57.27
Code of Federal Regulations induction cooking ranges 18.305(b)	Above 90 kHz	-55.69
NPRM non-consumer equipment	2400 - 2500 MHz	-65.23
NPRM consumer equipment	2400 - 2500 MHz	-71.25

4. Analysis

The current and proposed limits given in Section 3 are out-of-band only emission limits on RF lighting devices (i.e., out-of-band relative to the intended operating frequency band of the ISM device). There are no limits to the emissions from ISM devices within their operating frequency bands.

This analysis will consist of two parts: The first is to investigate the out-of-band emission limits and the second is to evaluate the current available data concerning RF lighting device emissions in their designated ISM band and signal spectra characteristics to determine the potential for interference from these RF lighting devices into Sirius receivers. For the out-of-band emission limits, the current and proposed limits will be evaluated to determine the extent of the potential interference to the Sirius receivers and make an evaluation of whether these limits will protect the receivers.

Interference analysis for satellite systems is typically expressed in terms of the increase in the wanted signal's noise temperature due to the interfering signal. This is appropriate since the Sirius receivers are very sensitive and the satellite signal to noise power ratio is low. The ITU generally uses a ÄT/T of 6% as the threshold for interference between different systems. This is equivalent to an Interference-to-noise density ratio (I/N) of -12.2 dB. For the Sirius receivers, an I/N from all sources of interference of -10 dB is felt to provide sufficient protection. This 2.2 dB liberalization may be optimistic and assumes there are no other major interfering sources. Thus, the potential interference into the Sirius receivers is evaluated using an I/N analysis with a criterion of I/N not to exceed -10 dB. For this analysis, the receiver reference bandwidth used is 1 MHz. If the current and proposed out-of-band field strength limits are shown to exceed this level, appropriate limits will be developed to ensure the protection of the receivers.

For the evaluation of the in-band emissions and signal spectrum of RF lighting devices, the analysis will look at the potential for out-of-band interference using measurement data to determine if the Sirius receivers will be protected to an I/N level of -10 dB. The purpose of this part of this analysis is to determine if RF lighting devices, as currently expected to operate, will be able to meet the out-of-band emission limits that will protect the Sirius receivers or, alternatively, determine by how much the required out-of-band emission limits would be exceeded by RF lighting devices.

5. Interference Scenarios

Under the FCC's current rules, ISM equipment may be operated on any frequency above 9 kHz (except for a few exceptions). The band 2400 - 2500 MHz is specifically allocated both internationally and in the US for ISM devices. The proposal for microwave RF lighting devices is in the 2400 - 2500 MHz band. For the purposes of this analysis, it will be assumed that RF lighting devices are operated in the 2400 - 2500 MHz band. (It should be noted that the FCC also has out-of-band emission limits for ISM devices that are not operating on ISM frequency bands. This limit results in an equivalent transmitted EIRP of about -61 dBW. The span of limits evaluated in this analysis will cover this limit. However, there may be a need to review this limit and propose appropriate modifications.)

The analysis will first investigate the potential interference from a single RF lighting device into a Sirius receiver. Next, an expected deployment model of RF lighting devices will be developed and the potential interference from multiple RF lighting devices into a Sirius receiver will be analyzed.

In the NPRM, the RF lighting devices expected to operate in the 2400 - 2500 MHz band are identified as an efficient, longer-lasting, high-power commercial lamp that is suitable for lighting coverage of large, commercial areas, such as warehouses, parking lots and shopping malls. In the NPRM, it is also stated that the FCC expects RF lighting devices to proliferate and to possibly include outdoor lighting, such as street lighting.

6. Out-of Band Emission Limits

6.1 Interference Scenario for One RF Lighting Source

This analysis will look at a mobile Sirius receiver that is located on a car that is either in a parking lot or on a street that is lit by one RF lighting source. In both cases, the RF lighting device is assumed to be located at a distance of 10 meters above the ground. The distance between the receiver and the RF lighting device will be varied to determine the necessary distance to protect the receivers to an I/N of -10 dB using the out-of-band emission levels given in Section 3.

For the fixed receiver case, the Sirius receiver will be assumed to be located on the roof of a house that is located on a road that is lit by RF lighting devices. The house is assumed to be 10 meters from the road and the RF lighting device is assumed to be at an altitude of 10 meters and on the other side of the road, which is 10 meters wide. Assuming the Sirius receiver is at an altitude near 10 meters, the resultant separation distance between the RF lighting device and the receiver is 20 meters.

In this analysis, it is assumed that the maximum EIRP of the RF lighting device is directed toward the Sirius receiver. There is very little information on the directional characteristics of the emissions from these lights and the shielding that will be used in such devices, so this is the approach that must be taken.

6.2 Interference Scenario for Multiple RF Lighting Sources

This analysis will consider a Sirius Satellite receiver located on a car that is either in a parking lot with four RF lighting devices or driving down a road that has multiple RF lighting devices. In the parking lot case, it is assumed that the lot is square, 100 meters on each side, and the lighting devices are located in the center of each side. The car will be located in several positions in the parking lot to determine the resultant I/N levels using the out-of-band emission limits given in Section 3. In the road case, 100 meters separate each RF lighting device from other RF lighting devices. The car will be located in several positions along the road and the resultant I/N levels using the out-of-band emission limits given in Section 3 are calculated. In both cases, the RF lighting device is assumed to be located 10 meters above the ground and transmitting its maximum EIRP into the Sirius receiver.

6.3 Analysis and Results

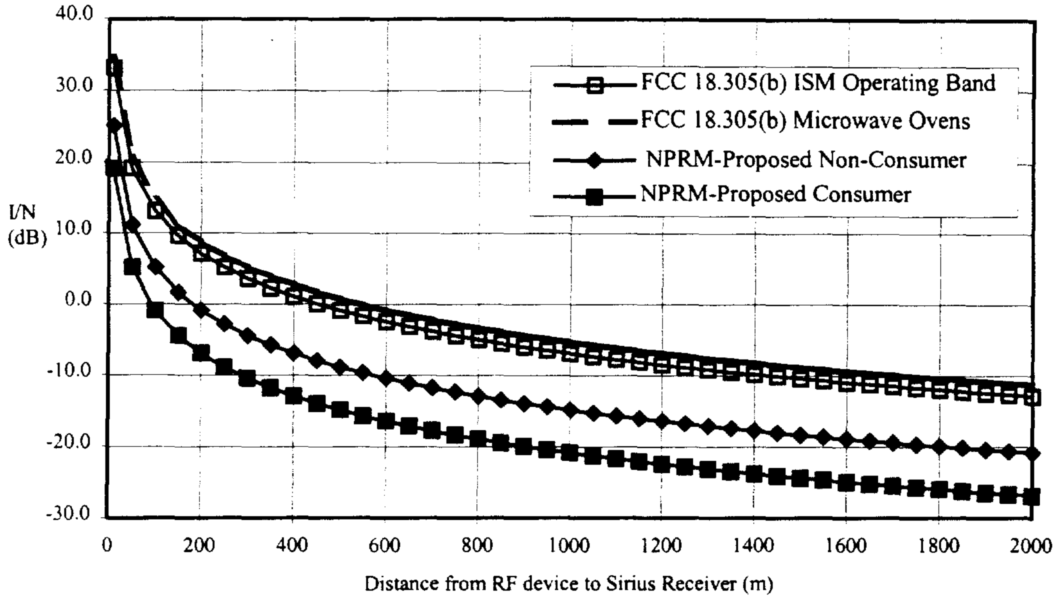
6.3.1 Interference from One RF Lighting Source

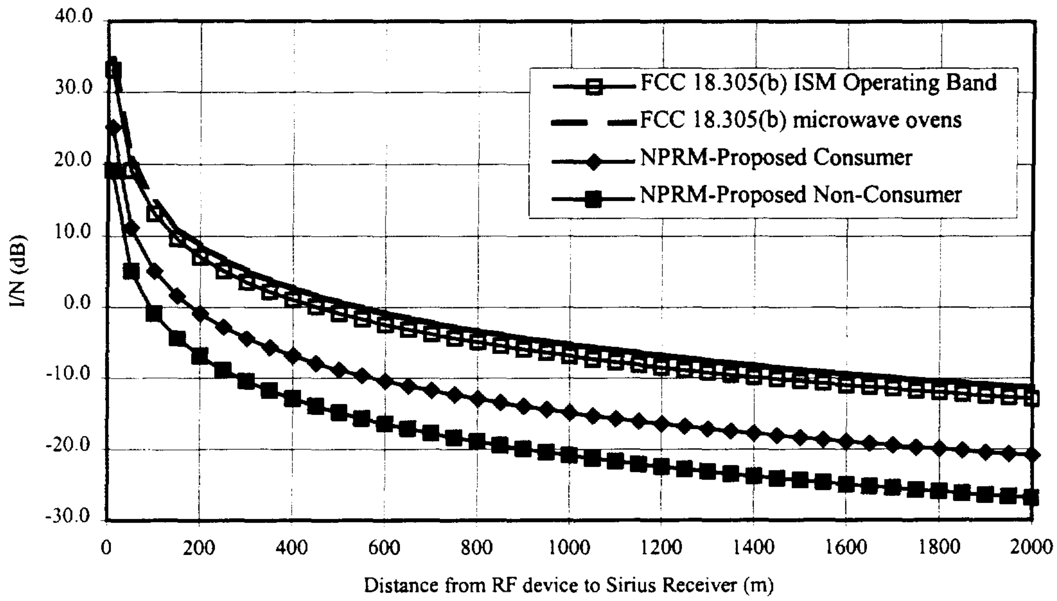
Table 6.3.1-1 gives the resultant I/N levels for the case where a Sirius mobile receiver (located on a car) is 10 meters away from an RF lighting device. The distance between the receiver and the RF lighting device is then varied to determine the I/N levels at the Sirius receiver. In this analysis, it is assumed that the receiver has an omnidirectional gain pattern and the gain is 3.5 dBi in all directions. Table 6.3.1-1 also includes the necessary separation distance to reach an I/N of -10 dB. Figure 6.3.1-1 shows the results of varying the separation distance between the receiver and the RF lighting device. Table 6.3.1-2 gives the resultant I/N levels for the case where a Sirius fixed receiver (located on a house) is 20 meters away from an RF lighting device.

Table 6.3.1-1 I/N Levels for Case where Mobile Receiver is located 10 Meters away from RF Lighting Device

	18.305(b) - misc.	18.305(b) - microwave ovens	NRPM Non-Consumer	NPRM - Consumer
Frequency (MHz)	2320	2320	2320	2320
Distance between RF Lighting Device and receiver (m)	10	10	10	10
Transmitted EIRP (dBW)	-57.27	-55.69	-65.23	-71.25
Path Loss (dB)	59.7	59.7	59.7	59.7
Receiver Antenna Gain (dBi)	3.5	3.5	3.5	3.5
Receiver Noise Power Density(dBW/MHz)	-146.6	-146.6	-146.6	-146.6
Interfering Signal Power Received (dBW)	-113.5	-111.9	-121.5	-127.5
I/N (dB)	33.1	34.7	25.1	19.1
Necessary separation distance to meet I/N of -10 dB (m)	1427.9	1713.4	571.1	285.6

Figure 6.3.1-1 I/N for Mobile Receiver from One RF Lighting Device as a Function of Separation Distance





These results indicate that, using the current limits in Section 18.305(b) of the FCC's rules will result in necessary separation distances of greater than 1400 meters. Using the proposed limits in the NPRM for consumer devices and non-consumer devices, the separation distances between the RF lighting device and a mobile Sirius Satellite receiver will have to be 571.1 and 285.6 meters, respectively, in order to achieve an I/N of -10 dB.

This analysis has shown that the proposed limits provide more protection for the Sirius receivers than the current limits in the FCC's rules, but do not provide enough protection. The next step of the analysis is to determine the appropriate out-of-band emission limits that will result in an I/N of -10 dB at a separation distance of 10 meters. Using the same assumptions as above, the transmitted EIRP of the RF lighting device would need to be -100.36 dBW. This is equivalent to an out-of-band field strength limit of 1.75 microvolts per meter at 30 meters or 0.175 microvolts per meter at 300 meters. It should be noted that the RF lighting signal is a continuous signal as opposed to the signal from a microwave oven, which is pulsed. In the RF lighting case, this signal level will always be present. For microwave ovens, the maximum signal level will be present infrequently and for short periods of time.

Table 6.3.1-2 I/N Levels for Case where Fixed Receiver is located 20 Meters away from RF Lighting Device

	18.305(b) - misc.	18.305(b) - microwave ovens	NRPM Non-Consumer	NPRM Consumer
Frequency (MHz)	2320	2320	2320	2320
Distance between RF Lighting Device and receiver (m)	20	20	20	20
Transmitted EIRP (dBW)	-57.27	-55.69	-65.23	-71.25
Path Loss (dB)	65.8	65.8	65.8	65.8
Receiver Antenna Gain (dBi)	3.5	3.5	3.5	3.5
Receiver Noise Power Density(dBW/MHz)	-146.6	-146.6	-146.6	-146.6
Interfering Signal Power Received (dBW)	-119.5	-118.0	-127.5	-133.5
I/N (dB)	27.1	28.7	19.1	13.1
Necessary separation distance to meet I/N of -10 dB (m)	1427.9	1713.4	571.1	285.6

These results indicate that a fixed receiver in this scenario would always receive interference from an RF lighting device that results in an I/N far exceeding -10 dB. In fact, these results indicate that if an RF lighting device is located at a large distance away from the Sirius receiver and either the existing or proposed field strength limits are adopted, the Sirius receiver will continuously receive interference that results in an I/N exceeding -10 dB. Using the same assumptions as above, the transmitted EIRP of the RF lighting device would need to be -94.34 dBW to meet an I/N of -10 dB in this fixed receiver case. This is equivalent to an out-of-band field strength limit of 3.5 microvolts per meter at 30 meters or 0.35 microvolts per meter at 300 meters.

6.3.2 Interference from Multiple RF Lighting Devices

6.3.2.1 Mobile Receiver Located in Parking Lot

In this analysis, a mobile Sirius Satellite receiver (located on a car) is positioned in a 100 meter by 100 meter parking lot. Three separate locations for the receiver are evaluated: 1) in the center of the parking lot, 2) in the upper right corner of the parking lot, and 3) directly under a RF lighting device. The third case is considered to be the maximum interference case and was evaluated to determine how much additional interference would be added by the other three RF lighting devices. As the previous single RF device case showed that the current and proposed out-of-band limits would exceed an I/N of -10 dB by a large amount and the likelihood that the more stringent of the NPRM-proposed limits would apply to outdoor RF lighting devices, only the NPRM-proposed non-consumer limits are used in this analysis. The resultant I/N values and necessary emission limits to meet an I/N of -10 dB are shown in Table 6.3.2.1-1.

Table 6.3.2.1-1 I/N Levels and Required Emission Limits to Meet I/N of -10 dB for Multiple RF Lighting Devices in Parking Lot Case

Location of Receiver	I/N (dB)	Required Emission Limits to Meet I/N of -10 dB
center of lot	11.0	4.46 microvolts/m @ 30 m
upper right corner of lot	8.8	5.75 microvolts/m @ 30 m
directly under one light	19.3	1.71 microvolts/m @ 30 m

These results indicate that in the assumed scenario, with the NPRM-proposed non-consumer out-of-band emission limits, a receiver located anywhere in the parking lot will receive an I/N much greater than -10 dB. For the minimum interference case, an emission limit of 5.75 microvolts per meter at 30 meters is required to meet an I/N of -10 dB. For the maximum interference case, the other three RF lighting devices caused the I/N to be 0.2 dB higher than the single RF lighting case and the required emission limit to meet an I/N of -10 dB is 0.04 microvolts per meter lower. This lower required field strength level is 1.71 microvolts per meter at 30 meters.

6.3.2.2 Mobile Receiver Located on Road

In this analysis, a mobile Sirius Satellite receiver (located on a car) is on a road with an RF lighting device every 100 meters. It is assumed that the receiver will receive interference from devices that are up to 500 meters away. Two separate locations for the receiver are evaluated: 1) halfway in between two RF lighting devices and 2) directly under an RF lighting device. In this analysis, only the NPRM-proposed non-consumer limits are used. The resultant I/N values and necessary emission limits to meet an I/N of -10 dB are shown in Table 6.3.2.2-1.

Table 6.3.2.2-1 I/N Levels and Required Emission Limits to Meet I/N of -10 dB for Multiple RF Lighting Devices in Road Case

Location of Receiver	I/N (dB)	Required Emission Limits to Meet I/N of -10 dB
in between two devices	8.7	5.79 microvolts/m @ 30 m
directly under one light	19.2	1.73 microvolts/m @ 30 m

These results indicate that in this assumed scenario, a receiver located anywhere along a road that has RF lighting devices will receive an I/N much greater than -10 dB. For the minimum interference case, an emission limit of 5.79 microvolts per meter at 30 meters is required to meet an I/N of -10 dB. For the maximum interference case, the other nine RF lighting devices caused the I/N to be 0.1 dB higher than the single RF lighting case and the required emission limits to meet an I/N of -10 dB is 0.02 microvolts per meter less than the single RF lighting case. This lower required field strength level is 1.73 microvolts per meter at 30 meters.

7. Evaluation of Expected Transmit EIRP and Signal Spectrum of RF Lighting Devices

The analysis for the evaluation of the expected RF lighting emissions will consist of using the results of measurements to determine the expected transmitted EIRP of the RF lighting devices within the ISM band and expected signal spectra of these emissions outside of the ISM band and in the Sirius receiver band. The single interfering RF lighting device case is the only one investigated in this section as the previous section showed that the resultant interference in the multiple cases assumed was very close to that of the single device case. The interference scenarios are that same that are used in the previous analysis.

In Fusion's May 19, 1999 ex parte filing to the FCC (filed by Fish & Richardson), it is stated that the mean peak measurement using a 1 MHz filter for ferroresonant lamps (six were tested) was 1959 millivolts per meter at 3 meters. For lamps with switching power supply measured with a 1 MHz filter, the average peak measurement was 883 millivolts per meter at 3 meters. Using the conversion equation from Section 3.1, the equivalent peak transmitted EIRPs for these lamps is 0.61 dBW for the ferroresonant lamps and -6.3 dBW for the lamps with switching power supply. These values will be used as the transmitted EIRP for the RF lighting devices in this analysis.

For the expected signal roll-off, three sources of information are used to estimate the expected signal roll-off: Measurements performed by NTIA and reported in Report 94-303-1 (March 1994); Fusion ex parte filing on May 19, 1999 (filed by Fish & Richardson); and the Eastman Kodak ex parte filing on February 4, 2000 (filed by Verner, Liipfert, Bernhard, McPherson and Hand).

The NTIA report gives the measured signal spectra of several microwave ovens. These measurements show that the emitted signal at a frequency of 2330 MHz is between 25 and 55 dB below the peak emitted signal level.

The Fusion ex parte filing shows that the emitted signal at 2397 MHz for a single ferroresonant power lamp is 38 dB down from the peak emitted signal level. For the lamps with switching power supply, the emitted signal at 2390 MHz is 59 dB below the peak emitted signal level.

The measurements from the Eastman Kodak Company of an RF light at the Smithsonian Air and Space Museum, show that the emitted signal level at 2400 MHz is about 46.7 dB below the peak emitted signal level. In this measurement, the signal level is the same from 2400 MHz to 2450 MHz. It is, thus, assumed that the signal level would remain the same as it is further removed from the carrier frequency and reaches the Sirius receive band.

As the NTIA report only addresses microwave ovens, which are pulsed signals, and not RF lighting devices, which will have continuous signals, the results of those measurements are not used in this analysis. They are cited to show that they obtained similar results to the measurements performed by Fusion and the Eastman Kodak Company. As the Fusion measurements only go to a frequency of 2397 MHz for the ferroresonant lamp and the signal has not yet flattened out, the Eastman Kodak measurements will be used for the ferroresonant lamp in the analysis. For the lamp with switching power supply, the measured signal roll-off as reported by Fusion will be used in the analysis.

7.1 Evaluation of Interference Received from a Single RF Lighting Device using the Expected Transmit EIRP and Signal Spectrum of RF Lighting Devices

Table 7.1-1 gives the resultant I/N levels for the case where a Sirius mobile receiver (located on a car) is 10 meters away from an RF lighting device with the characteristics described in Section 7. In this analysis, it is assumed that the receiver has an omnidirectional gain pattern and the gain is 3.5 dBi in all directions.

Table 7.1.1-1 I/N Levels for Case where Mobile Receiver is located 10 Meters away from RF Lighting Device

	ferroresonant lamp	lamp with switching power supply
Frequency (MHz)	2330	2330
Distance between RF Lighting Device and receiver (m)	10	10
Peak Field Strength (millivolts per meter)	1959	883
Field strength distance (m)	3.0	3.0
Transmitted EIRP (dBW)	0.61	-6.31
Signal Roll-off (dB)	-46.69	-59.0
Path Loss (dB)	59.8	59.8
Receiver Antenna Gain (dBi)	3.5	3.5
Receiver Noise Power Density (dBW/kHz)	-146.6	-146.6
Interfering Signal Power Received (dBW)	-102.4	-121.6
I/N (dB)	44.2	25.0
Necessary separation distance to meet I/N of -10 dB (m)	5157.2	563.4
Additional Signal Attenuation Needed to Meet I/N of -10 dB	54.2	35.0

This analysis has shown that the resultant I/N of the Sirius receiver due to the expected in-band emissions and signal spectrum out-of-band of RF lighting devices at a separation distance of 10 meters,, would far exceed -10 dB. The required separation distance to meet an I/N of -10 dB is very large. For the lamps that are being used now, an additional 54.2 dB of signal attenuation is necessary. These results indicate that additional filtering is necessary for these RF lighting devices to sufficiently protect the Sirius receivers.

8. Summary and Conclusions

The analysis performed for this report using the current and proposed field strength levels of emissions which lie outside of bands allocated to ISM devices for RF lighting devices have shown that the interference to Sirius receivers will be excessive. In order to achieve an I/N of -10 dB, the separation distances between the RF lighting device and the mobile receiver are very large. Analysis has shown that an out-of-band field strength limit of 1.7 microvolts per meter at 30 meters would result in an I/N of -10 dB. Any field strength limit that is higher than this will result in some amount of interference to the Sirius receivers. It seems appropriate that the limits that protect the Sirius receivers need to be specified in the FCC's rules. Consequently, a change to Section 18.305(b) or 18.305(c) is necessary. The analysis presented in this document would also apply to other systems that supply digital audio radio services from satellites.

The second part of the analysis used expected transmitted EIRPs of the RF lighting devices and the results of several measurements to determine what the expected out-of-band interference to the Sirius receiver would be. Using these characteristics results in an I/N exceeding -10 dB at even very large distances. For the lamps that are being used now, an additional 54.2 dB of signal attenuation is necessary to meet an I/N of -10 dB. It is clear from this analysis that the expected signal powers produced by RF lighting devices, without filtering, will result in an I/N exceeding -10 dB into Sirius receivers. The conclusion to be drawn from this is that it is necessary for the RF lighting devices to use some type of filtering to protect Sirius receivers operating out-of-band to the RF lighting devices. Additionally, filtering of the RF lighting signals would result in reduced interference to other authorized users of the bands outside of the ISM bands.

It is concluded that there are three methods (or combinations thereof) to avoid interference from RF lighting devices into Sirius S-DARS receivers:

1. Prohibit RF lighting devices from being closer to S-DARS receivers than 571 meters on an individual or distributed basis, assuming the non-consumer NPRM limit is adopted.

2. Establish an RF lighting device maximum EIRP of –55 dBW (325 microvolts per meter at 30 meters) with an assumed 45 dB spectrum roll off.

3. Require RF lighting device out-of-band EIRP in the 2320-2345 MHz range to be no more than –100 dBW (1.8 microvolts per meter at 30 meters).

CERTIFICATE OF SERVICE

I hereby certify that on this 25th day of May, 2000, I caused copies of the foregoing **Ex Parte Filing of Sirius Satellite Radio Inc.** to be mailed via first-class postage prepaid mail to the following:

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